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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**  
**BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

In re the application of:

HSUEH SUNG TUNG, ET AL.

Docket: H0005034

Serial Number: 10/671,810

Group Art Unit: 1621

Filed: September 26, 2003

Examiner: Sikarl A. Witherspoon

For: METHOD OF MAKING 1,1,3,3,3-PENTAFLUOROPROPENE

**APPEAL BRIEF**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

This is an Appeal to the Board of Patent Appeals and Interferences from the Final Rejection of claims 1-4, 6-42, 44-68, 70, and 72-75 mailed June 24, 2005 in the above identified case. A Notice of Appeal was filed on December 23, 2005. An oral hearing is not requested.

The Commissioner is authorized to charge the required appeal brief fee of \$500.00 to Deposit Acct. No. 01-1125. In the event that the Commissioner determines that an additional extension of time is required in order for this submission to be timely, it is requested that this submission include a petition for an additional extension for the required length of time and the Commissioner is authorized to charge any other fees necessitated by this paper to Deposit Acct. No. 01-1125.

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#### I. REAL PARTY IN INTEREST

The real party in interest is Honeywell International, Inc., the assignee of record.

#### II. RELATED APPEALS AND INTERFERENCES

With respect to other appeals or interferences that will directly affect, or be directly affected by, or have a bearing on the Board's decision in this appeal, please note that there are no other related applications on appeal or subject to an interference known to appellant, appellant's legal representative or the assignee.

#### III. STATUS OF CLAIMS

The claims in the application are 1-75. Claims 1-4, 6-42, 44-68, 70, and 72-25 are pending, stand rejected, and are on appeal. Claims 69 and 71 are objected to. Claims 5 and 43 have been canceled. No claims are allowed.

#### IV. STATUS OF AMENDMENTS

No response was filed after final rejection.

#### V. SUMMARY OF THE CLAIMED SUBJECT MATTER

Support for the claimed processes can be found throughout the specification.

The present invention claims a process for the manufacture of 1,1,3,3,3-pentafluoropropene comprising reacting a reactant comprising 1,1,1,3,3,3-hexafluoropropane and optionally additionally 1-chloro-1,1,3,3,3-pentafluoropropane, with a caustic under conditions sufficient to dehydrofluorinate 1,1,1,3,3,3-hexafluoropropane and optionally additionally dehydrochlorinate 1-chloro-1,1,3,3,3-pentafluoropropane, to form a reaction product which comprises 1,1,3,3,3-

pentafluoropropene. Support for this process can be found throughout the specification, particularly on page 3, lines 13 through 19 and after.

The present invention further claims a process for the manufacture of 1,1,3,3,3-pentafluoropropene comprising thermally decomposing a reactant comprising at least one of 1-chloro-1,1,3,3,3-pentafluoropropane and 1,1,1,3,3,3-hexafluoropropane, under conditions sufficient to dehydrochlorinate 1-chloro-1,1,3,3,3-pentafluoropropane and/or to dehydrofluorinate 1,1,1,3,3,3-hexafluoropropane, to form a reaction product which comprises 1,1,3,3,3-pentafluoropropene and wherein the decomposing is conducted either without a catalyst or with a catalyst selected from the group consisting of supported transition metal halides, supported transition metal oxides, bulk transition metal oxides, and combinations thereof. Support for this process can be found throughout the specification, particularly on page 3 line 21 through page 4 line 3, and the originally filed claim 43.

The invention further claims a process for the manufacture of 1,1,3,3,3-pentafluoropropene comprising thermally decomposing a reactant comprising 1-chloro-1,1,3,3,3-pentafluoropropane, under conditions sufficient to dehydrochlorinate 1-chloro-1,1,3,3,3-pentafluoropropane, to form a reaction product which comprises 1,1,3,3,3-pentafluoropropene and wherein the decomposing is conducted either without a catalyst or with a catalyst selected from the group consisting of transition metal halides and oxides and combinations thereof. Support for this process can be found throughout the specification, particularly on page 3, lines 13 through 19 and after.

The invention still further claims a process for the manufacture of 1,1,3,3,3-pentafluoropropene comprising thermally decomposing a reactant comprising at least one of 1-chloro-1,1,3,3,3-pentafluoropropane and 1,1,1,3,3,3-hexafluoropropane, under conditions sufficient to dehydrochlorinate 1-chloro-1,1,3,3,3-pentafluoropropane and/or to dehydrofluorinate 1,1,1,3,3,3-hexafluoropropane, to form a reaction product which comprises 1,1,3,3,3-pentafluoropropene and wherein the decomposing is conducted with

a catalyst selected from the group consisting of iron halides, nickel halides, cobalt halides and combinations thereof. Support for this process can be found throughout the specification, particularly on page 3 line 21 through page 4 line 3 and after.

VI. GROUND OF REJECTION TO BE REVIEWED ON APPEAL

(a) Claims 1-4 and 6-31 stand rejected under 35 U.S.C. 103 over Henne et al. in view of Mallikarjuna et al., Merkel et al., Nappa et al., and Tung et al.

(b) Claim 70 stands rejected under 35 U.S.C. 103 over Henne et al. in view of Aoyama et al.

(c) Claim 32-42, 44-68, 72, and 74-75 stand rejected under 35 U.S.C. 103 over Mallikarjuna et al. in view of Nappa et al. and Tung et al.

(d) Claim 73 stands rejected under 35 U.S.C. 103 over Mallikarjuna et al. in view of Nappa et al.

(e) Claims 69 and 71 are objected to as being dependent upon rejected base claim 1.

## VII. ARGUMENTS

(a) The Examiner has rejected claims 1-4 and 6-31 under 35 U.S.C. 103 as being unpatentable over Henne et al. in view of Mallikarjuna et al. and in further view of Merkel et al., Nappa et al., and Tung et al. It is respectfully asserted that this ground of rejection should be overruled.

Appellants first submit that the complexity of the rejection in itself is indicative of the non-obviousness of the invention. In this regard it is noted that features from a total of 5 references must be selectively extracted, extrapolated and combined in order for the Examiner to assert his rejection. The Examiner's approach seems to be to cite a string of references, figuratively throw all the ingredients of the reference teachings in one pot, and then pull out whichever ingredients are needed to reconstruct the claimed invention. It is urged that one skilled in the art would not have known which ingredients to combine, absent the guidance provided in the present application. Where Applicants' teachings are needed to find the invention, the invention is not obvious. Obviousness is determined at the time the invention is made, not after reading Applicants' teaching. 35 U.S.C. 103. Furthermore, citing references to merely indicate that isolated elements recited in the claims are known is not a sufficient basis for a conclusion of obviousness; there must be something that suggests the desirability of combining the references in a manner calculated to arrive at the claimed invention. Ex parte Hiyamizu, 10 U.S.P.Q.2d 1393, 1394 (PTO Bd. Pat. Ap. and Int., 1988). It is respectfully submitted that such a strained analysis fails to demonstrate that the invention as a whole is obvious in view of this combination of references:

This application claims:

1. A process for the manufacture of 1,1,3,3,3-pentafluoropropene comprising reacting a reactant comprising 1,1,1,3,3,3-hexafluoropropane *and optionally additionally 1-chloro-1,1,3,3,3-pentafluoropropane*, with a caustic under conditions sufficient to dehydrofluorinate 1,1,1,3,3,3-

hexafluoropropane *and optionally additionally dehydrochlorinate 1-chloro-1,1,3,3,3-pentafluoropropane*, to form a reaction product which comprises 1,1,3,3,3-pentafluoropropene.

In the process of Claims 1-31 and 69-70, it is mandatory that HFC-236fa is dehydrofluorinated with caustic to HFC-1225zc. It is additionally optional that HCFC-235fa be dehydrochlorinated to HFC-1225zc. This is not suggested by any combination of references.

Henne et al. *solely* mentions a reaction of HCFC-235fa with an alcoholic potassium hydroxide. As the examiner agrees, Henne et al. neither teach nor suggest a process for reacting HFC-236fa or a combination of both HCFC-235fa and HFC-236fa. As the examiner also apparently agrees, Mallikarjuna et al. does not teach dehydrofluorination of HFC-236fa. Rather, Mallikarjuna et al. solely teach a process employing HFC-236fa and a different reagent, namely a *very specific crystalline, cubic chromium trifluoride*. There is clearly no suggestion from the art that Henne et al.'s HCFC-235fa could or should be reacted with Mallikarjuna et al.'s crystalline, cubic chromium trifluoride nor that the hypothetical result would be 1,1,3,3,3-pentafluoropropene. Likewise, there is no suggestion from the art that Mallikarjuna et al.'s HFC-236fa could or should be reacted with Henne et al.'s alcoholic potassium hydroxide, nor that the hypothetical result would be 1,1,3,3,3-pentafluoropropene. This is at least because Mallikarjuna et al. do not suggest dehydrochlorination and Henne et al. do not suggest dehydrofluorination. Henne et al. do not suggest *any* reaction involving HFC-236fa, nor crystalline, cubic chromium trifluoride. Furthermore, Mallikarjuna et al. do not suggest *any* reaction involving HCFC-235fa, nor a caustic, and they must employ a crystalline, cubic chromium trifluoride. It is urged that the Examiner is impermissibly attempting to reconstruct the art in light of Appellant's disclosure, without any suggestion from the art to do so. Just because precursors to 1,1,3,3,3-pentafluoropropene are known, and dehydrofluorination techniques are known, does not provide motivation for one skilled in the art to dehydrofluorinate 1,1,3,3,3-hexafluoropropane with a caustic to

1,1,3,3,3-pentafluoropropene, nor to dehydrochlorinate 1-chloro-1,1,3,3,3-pentafluoropropane to 1,1,3,3,3-pentafluoropropene.

With regard to Merkel et al., as the examiner admits, this reference teaches the purification of a *completely different product*, namely, a fluoropropane. Merkel et al. has nothing whatsoever to do with the production of fluoropropene, much less 1,1,3,3,3-pentafluoropropene. Fluoropropanes and fluoropropenes are not analogs, homologs or isomers and this are not suggestive of one another. There is no suggestion from the applied art that one should use fluoropropane purification techniques to purify 1,1,3,3,3-pentafluoropropene. Such a position is mere speculation and an impermissible reconstruction of the art in light of Appellant's disclosure. It is therefore submitted that this ground of rejection should be overruled. Merkel et al. does not teach or suggest purification of halohydrocarbons in general. Furthermore, claim 2 requires the subsequent step of purifying the resulting 1,1,3,3,3-pentafluoropropene. Merkel et al. mentions *absolutely nothing* about purifying 1,1,3,3,3-pentafluoropropene. Assuming that there was a desire to purify 1,1,3,3,3-pentafluoropropene, Merkel et al. does not teach one how to do so. It is submitted that the rejection based on Merkel et al. employs an "obvious to try" standard, and involves a reconstruction of the art in light of Appellant's disclosure. It is impermissible for the examiner to "take the position it would have been obvious to a person of ordinary [sic: skill in the art] to employ the purification process taught by Merkel et al in the dehydrofluorination process taught by Henne et al. ".....absent a showing to the contrary.....". It is the obligation of the examiner in the first instance to assert a *prima facie* case of obviousness in the first instance before the burden shifts to the Applicant to provide a showing to the contrary. Here the examiner has only stated an unsupported opinion without any showing from the art that Merkel's purification of 1,1,1,3,3,3 pentafluoropropane would be applicable to purifying 1,1,3,3,3-pentafluoropropene.

Nappa et al. and Tung et al. teach the preparation of fluoropropanes. That is, Nappa et al. teach the preparation of 1,1,1,3,3,3-hexafluoropropane (HFC-236fa) but not 1-chloro-1,1,3,3,3-pentafluoropropane (HCFC-235fa). Tung et al. teach the existence of



1,1,1,3,3,3-hexafluoropropane and 1-chloro-1,1,3,3,3-pentafluoropropane. However, as argued above, *none* of the cited art teaches the required step of reacting a reactant comprising 1,1,1,3,3,3-hexafluoropropane with a caustic under conditions sufficient to dehydrofluorinate 1,1,1,3,3,3-hexafluoropropane. Therefore it is clear that Nappa et al. and Tung et al. in no way relate to claims 1-11. Upon the expected removal of references Henne et al., Mallikarjuna et al., and Merkel et al., it is urged that Nappa et al. and Tung et al. are no longer applicable to the claims as a whole. It is therefore requested that the rejection under 35 U.S.C. 103 should be overruled.

(b) The Examiner has rejected claim 70 under 35 U.S.C. 103 as being unpatentable over Henne et al. in view of Aoyama et al. It is respectfully submitted that this ground of rejection should be removed.

As stated above, claim 70, which depends from claim 1, requires reacting 1,1,1,3,3,3-hexafluoropropane (HFC-236fa) with a caustic under conditions sufficient to dehydrofluorinate 1,1,1,3,3,3-hexafluoropropane to form 1,1,3,3,3-pentafluoropropene (HFC-1225zc). However, Henne et al. has *nothing* whatsoever to do with 1,1,1,3,3,3-hexafluoropropane (HFC-236fa) and in fact does not even mention 1,1,1,3,3,3-hexafluoropropane at all. Henne et al. only mention 1-chloro-1,1,3,3,3-pentafluoropropane (HCFC-235fa). Since the activity of halocarbons is largely empirically determined, the activity of 1-chloro-1,1,3,3,3-pentafluoropropane cannot predict the activity of 1,1,1,3,3,3-hexafluoropropane. These components are not analogs, homologs or isomers of one another and therefore one cannot assume similar activity. Aoyama et al. has *nothing* whatsoever to do with reactions of potassium hydroxide with 1,1,1,3,3,3-hexafluoropropane (HFC-236fa) or 1-chloro-1,1,3,3,3-pentafluoropropane (HCFC-235fa). Rather, Aoyama et al. discusses potassium hydroxide in dibutylether with a different reagent, namely 1,1,1,2,3,3-hexafluoropropane to produce 1,1,1,2,3,3-hexafluoropropene. For these reasons, it is submitted that the rejection under 35 U.S.C. 103 should be overruled.

(c) The Examiner has rejected claims 32-42, 44-68, 72, and 74-75 under 35 U.S.C. 103 as being unpatentable over Mallikarjuna et al. in view of Nappa et al. and Tung et al.

The claims are directed to a process for the manufacture of 1,1,3,3,3-pentafluoropropene comprising *thermally decomposing* a reactant comprising at least one of 1-chloro-1,1,3,3,3-pentafluoropropane and 1,1,1,3,3,3-hexafluoropropane, under conditions sufficient to dehydrochlorinate 1-chloro-1,1,3,3,3-pentafluoropropane and/or to dehydrofluorinate 1,1,1,3,3,3-hexafluoropropane, to form a reaction product which comprises 1,1,3,3,3-pentafluoropropene and wherein the decomposing is conducted either without a catalyst or with a catalyst selected from the group consisting of supported transition metal halides, supported *transition metal* oxides, *bulk transition metal* oxides, and combinations thereof.

As stated above, Mallikarjuna et al. teach a process *solely* employing 1,1,1,3,3,3-hexafluoropropane (HFC-236fa) and a very specific crystalline, cubic chromium trifluoride. A process for forming 1-chloro-1,1,3,3,3-pentafluoropropane (HCFC-235fa) is *not* disclosed. Mallikarjuna et al. further does not suggest the dehydrofluorination or dehydrochlorination steps required by the present claims.

Nappa et al. and Tung et al. teach the preparation of fluoropropanes. With further regard to claim 33, cubic chromium trifluoride is not an analog, homolog or isomer of iron halides, nickel halides, or cobalt halides and hence one would not suggest the other. The fact that each contains a transition metal moiety is *insufficient* for one to suggest the other to those skilled in the art. Since there is no prima facie case of obviousness stated in the first instance, no showing of unexpected results is required. Again, Mallikarjuna et al. has *nothing* to do with 1-chloro-1,1,3,3,3-pentafluoropropane (HCFC-235fa). It is therefore submitted that this ground of rejection should be overruled.

(d) The Examiner has rejected claim 73 under 35 U.S.C. 103 as being unpatentable over Mallikarjuna et al. in view of Nappa et al. Claim 73, which depends from claim 32,

provides a further limited embodiment wherein the decomposing step is conducted with a catalyst selected from the group consisting of supported *transition metal oxides*, *bulk transition metal oxides*, and *combinations thereof*.

The Examiner agrees that Mallikarjuna et al. fails to teach metal oxide catalysts and thus cites Nappa et al., asserting that it would have been obvious to substitute Nappa's transition metal oxides for the transition metal halides of Mallikarjuna. Again, Appellants respectfully disagree with the Examiner's assertion, and urge that one skilled in the art *would not* have combined these references in an effort to formulate the claimed invention. As stated above, Mallikarjuna et al. teach a process *solely* employing 1,1,1,3,3,3-hexafluoropropane (HFC-236fa), and having *nothing* to do with 1-chloro-1,1,3,3,3-pentafluoropropane (HCFC-235fa). In addition, Nappa et al. teach the preparation of 1,1,1,3,3,3-hexafluoropropane (HFC-236fa) but *not* 1-chloro-1,1,3,3,3-pentafluoropropane (HCFC-235fa). A reference has to offer sufficient motivation for one skilled in the art to achieve the desired result. "Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination." In re Geiger, 2 U.S.P.Q.2d 1276, 1278 (CAFC 1987). In the instant case, the motives in the references, as disclosed by the practices therein, are quite different from those in the instant invention. The present invention, therefore, is not made obvious by the combination the Examiner has suggested, and the 35 U.S.C. 103 rejection should, therefore, be overruled.

(e) The Examiner has objected to claims 69 and 71 as being dependent from a rejected base claim. Appellants submit that the rejection of base claim 1 should be overruled in view of the above arguments, thereby obviating the objections to claims 69 and 71. It is therefore respectfully submitted that this objection should be overruled in view of the

above arguments.

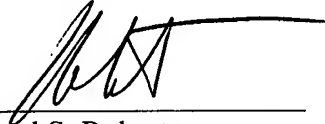
For all the above reasons, the pending claims are urged to be patentable over the cited references, and the rejections under 35 U.S.C.103 should be overruled.

Respectfully submitted,



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I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, postage pre-paid in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on February 23, 2006.



Richard S. Roberts

## VIII. CLAIMS APPENDIX

1. A process for the manufacture of 1,1,3,3,3-pentafluoropropene comprising reacting a reactant comprising 1,1,1,3,3,3-hexafluoropropane and optionally additionally 1-chloro-1,1,3,3,3-pentafluoropropane, with a caustic under conditions sufficient to dehydrofluorinate 1,1,1,3,3,3-hexafluoropropane and optionally additionally dehydrochlorinate 1-chloro-1,1,3,3,3-pentafluoropropane, to form a reaction product which comprises 1,1,3,3,3-pentafluoropropene.
2. The process of claim 1 further comprising the subsequent step of purifying the resulting 1,1,3,3,3-pentafluoropropene.
3. The process of claim 1 further comprising the subsequent step of purifying the resulting 1,1,3,3,3-pentafluoropropene by washing with a caustic solution, drying and distilling.
4. The process of claim 1 wherein the reactant does not comprise 1-chloro-1,1,3,3,3-pentafluoropropane.
5. (Canceled).
6. The process of claim 1 wherein the reactant comprises both 1-chloro-1,1,3,3,3-pentafluoropropane and 1,1,1,3,3,3-hexafluoropropane.
7. The process of claim 1 wherein said caustic comprises NaOH, KOH, Ca(OH)<sub>2</sub>, CaO or combinations thereof.
8. The process of claim 1 wherein said dehydrochlorination of 1-chloro-1,1,3,3,3-pentafluoropropane and said dehydrofluorination of 1,1,1,3,3,3-hexafluoropropane are conducted simultaneously in the same reactor.

9. The process of claim 1 wherein the reaction is conducted at a temperature of from about 20°C to about 150°C.

10. The process of claim 1 wherein the reaction is conducted at atmospheric pressure, superatmospheric pressure or under vacuum.

11. The process of claim 1 wherein the caustic strength of said caustic is from about 2 wt % to about 100 wt % optionally in water.

12. The process of claim 1 wherein the 1-chloro-1,1,3,3,3-pentafluoropropane and/or 1,1,1,3,3,3-hexafluoropropane are previously prepared by fluorinating 1,1,1,3,3,3-hexachloropropane with hydrogen fluoride in a vapor phase in the presence of a fluorination catalyst.

13. The process of claim 12 wherein said fluorination catalyst is selected from the group consisting of transition metal halides, Group IVb metal halides, Group Vb metal halides and combinations thereof on activated carbon or fluorinated alumina.

14. The process of claim 12 wherein said fluorination catalyst is selected from the group consisting of SbCl<sub>5</sub>, SbCl<sub>3</sub>, SbF<sub>5</sub>, TaCl<sub>5</sub>, SnCl<sub>4</sub>, NbCl<sub>5</sub>, TiCl<sub>4</sub>, MoCl<sub>5</sub>, Cr<sub>2</sub>O<sub>3</sub>, Cr<sub>2</sub>O<sub>3</sub>/Al<sub>2</sub>O<sub>3</sub>, Cr<sub>2</sub>O<sub>3</sub>/AlF<sub>3</sub>, Cr<sub>2</sub>O<sub>3</sub>/carbon, CoCl<sub>2</sub>/Cr<sub>2</sub>O<sub>3</sub>/Al<sub>2</sub>O<sub>3</sub>, NiCl<sub>2</sub>/Cr<sub>2</sub>O<sub>3</sub>/Al<sub>2</sub>O<sub>3</sub>, CoCl<sub>2</sub>/AlF<sub>3</sub>, NiCl<sub>2</sub>/AlF<sub>3</sub> and combinations thereof.

15. The process of claim 12 wherein said fluorination catalyst is selected from the group consisting of Cr<sub>2</sub>O<sub>3</sub>, Cr<sub>2</sub>O<sub>3</sub>/carbon, Cr<sub>2</sub>O<sub>3</sub>/AlF<sub>3</sub>, CoCl<sub>2</sub>/AlF<sub>3</sub>, NiCl<sub>2</sub>/AlF<sub>3</sub> and combinations thereof.

16. The process of claim 12 wherein said fluorination catalyst comprises SbCl<sub>3</sub> or SbCl<sub>5</sub> supported on activated carbon.

17. The process of claim 1 wherein the 1-chloro-1,1,3,3,3-pentafluoropropane and/or 1,1,1,3,3,3-hexafluoropropane are previously prepared by fluorinating 1,1,1,3,3,3-hexachloropropane with hydrogen fluoride in a liquid phase in the presence of a fluorination catalyst.
18. The process of claim 17 wherein said fluorination catalyst is selected from the group consisting of transition metal halides, Group IVb metal halides, Group Vb metal halides and combinations thereof.
19. The process of claim 17 wherein said fluorination catalyst is selected from the group consisting of  $\text{SbCl}_5$ ,  $\text{SbCl}_3$ ,  $\text{SbF}_5$ ,  $\text{TaCl}_5$ ,  $\text{SnCl}_4$ ,  $\text{NbCl}_5$ ,  $\text{TiCl}_4$ ,  $\text{MoCl}_5$ , and combinations thereof.
20. The process of claim 17 wherein said fluorination catalyst is selected from the group consisting of  $\text{SbCl}_5$ ,  $\text{SbCl}_3$  and combinations thereof.
21. The process of claim 12 wherein the fluorination is conducted at a temperature of from about  $80^\circ\text{C}$  to about  $400^\circ\text{C}$ .
22. The process of claim 12 wherein the fluorination is conducted at atmospheric pressure, superatmospheric pressure or under vacuum.
23. The process of claim 12 wherein the mole ratio of hydrogen fluoride to 1,1,1,3,3,3-hexachloropropane is from about 2:1 to about 100:1.
24. The process of claim 12 further comprising feeding chlorine to the fluorination reaction to keep the fluorination catalyst active.
25. The process of claim 17 wherein the fluorinating is conducted at a temperature of from about  $65^\circ\text{C}$  to about  $150^\circ\text{C}$ .

26. The process of claim 17 wherein the fluorinating is conducted at a pressure of from about 50 psig and 400 psig.

27. The process of claim 17 wherein the fluorinating is conducted at a pressure of from about 60 psig to about 200 psig.

28. The process of claim 17 wherein the mole ratio of hydrogen fluoride to 1,1,1,3,3,3-hexachloropropane is from about 2:1 to about 100:1.

29. The process of claim 17 wherein the mole ratio of hydrogen fluoride to 1,1,1,3,3,3-hexachloropropane is from about 6:1 to about 20:1.

30. The process of claim 17 further comprising feeding chlorine to the fluorination reaction to keep the fluorination catalyst active.

31. The process of claim 30 wherein the chlorine is fed to the fluorination reaction in an amount of from about 0.1 mol% to about 10 mol% based on the sum of the quantity of 1,1,1,3,3,3-hexachloropropane and recycled intermediates.

32. A process for the manufacture of 1,1,3,3,3-pentafluoropropene comprising thermally decomposing a reactant comprising at least one of 1-chloro-1,1,3,3,3-pentafluoropropane and 1,1,1,3,3,3-hexafluoropropane, under conditions sufficient to dehydrochlorinate 1-chloro-1,1,3,3,3-pentafluoropropane and/or to dehydrofluorinate 1,1,1,3,3,3-hexafluoropropane, to form a reaction product which comprises 1,1,3,3,3-pentafluoropropene and wherein the decomposing is conducted either without a catalyst or with a catalyst selected from the group consisting of supported transition metal halides, supported transition metal oxides, bulk transition metal oxides, and combinations thereof.



33. The process of claim 32, the catalyst is selected from, a group consisting of iron halides, nickel halides, cobalt halides and combinations thereof.
34. The process of claim 32 wherein 1-chloro-1,1,3,3,3-pentafluoropropane is dehydrochlorinated to form a reaction product which comprises 1,1,3,3,3-pentafluoropropene.
35. The process of claim 32 wherein 1,1,3,3,3-hexafluoropropane is dehydrofluorinated to form a reaction product which comprises 1,1,3,3,3-pentafluoropropene.
36. The process of claim 32 wherein both 1-chloro-1,1,3,3,3-pentafluoropropane is dehydrochlorinated and 1,1,1,3,3,3-hexafluoropropane is dehydrofluorinated to form a reaction product which comprises 1,1,3,3,3-pentafluoropropene.
37. The process of claim 35 wherein said dehydrochlorination of 1-chloro-1,3,3,3-tetrafluoropropane and said dehydrofluorination of 1,1,1,3,3,3-hexafluoropropane are conducted simultaneously in the same reactor.
38. The process of claim 32 which is conducted at a temperature of from about 30°C to about 400°C.
39. The process of claim 32 which is conducted at a temperature of from about 50°C to about 350°C.
40. The process of claim 32 which is conducted at a temperature of from about 75°C to about 300°C.
41. The process of claim 32 which is conducted at atmospheric pressure, superatmospheric pressure or under vacuum.

42. The process of claim 32 which is conducted in the presence of the catalyst.
43. (Canceled).
44. The process of claim 42 wherein said catalyst comprises supported or bulk  $\text{FeCl}_2$ ,  $\text{FeCl}_3$ ,  $\text{NiCl}_2$  or  $\text{CoCl}_2$ .
45. The process of claim 32 wherein the 1-chloro-1,1,3,3,3-pentafluoropropane and/or 1,1,1,3,3,3-hexafluoropropane are previously prepared by fluorinating 1,1,1,3,3,3-hexachloropropane with hydrogen fluoride in the vapor phase in the presence of a fluorination catalyst.
46. The process of claim 45 wherein said fluorination catalyst is selected from the group consisting of transition metal halides, Group IVb metal halides, Group Vb metal halides and combinations thereof on activated carbon or fluorinated alumina.
47. The process of claim 45 wherein said fluorination catalyst is selected from the group consisting of  $\text{SbCl}_5$ ,  $\text{SbCl}_3$ ,  $\text{SbF}_5$ ,  $\text{TaCl}_5$ ,  $\text{SnCl}_4$ ,  $\text{NbCl}_5$ ,  $\text{TiCl}_4$ ,  $\text{MoCl}_5$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{Cr}_2\text{O}_3/\text{Al}_2\text{O}_3$ ,  $\text{Cr}_2\text{O}_3/\text{AlF}_3$ ,  $\text{Cr}_2\text{O}_3/\text{carbon}$ ,  $\text{CoCl}_2/\text{Cr}_2\text{O}_3/\text{Al}_2\text{O}_3$ ,  $\text{NiCl}_2/\text{Cr}_2\text{O}_3/\text{Al}_2\text{O}_3$ ,  $\text{CoCl}_2/\text{AlF}_3$ ,  $\text{NiCl}_2/\text{AlF}_3$  and combinations thereof.
48. The process of claim 45 wherein said fluorination catalyst is selected from the group consisting of  $\text{Cr}_2\text{O}_3$ ,  $\text{Cr}_2\text{O}_3/\text{carbon}$ ,  $\text{Cr}_2\text{O}_3/\text{AlF}_3$ ,  $\text{CoCl}_2/\text{AlF}_3$ ,  $\text{NiCl}_2/\text{AlF}_3$  and combinations thereof.
49. The process of claim 45 wherein said fluorination catalyst comprises  $\text{SbCl}_3$  or  $\text{SbCl}_5$  supported on activated carbon.
50. The process of claim 45 wherein the fluorinating is conducted at a temperature of from about  $0^\circ\text{C}$  to about  $400^\circ\text{C}$ .

51. The process of claim 45 wherein the fluorinating is conducted at a temperature of from about 200°C to about 330°C.

52. The process of claim 45 wherein the fluorinating is conducted at superatmospheric, atmospheric pressures or under vacuum.

53. The process of claim 45 wherein the fluorinating is conducted at a pressure of from about 50 psig to about 200 psig.


54. The process of claim 45 wherein the mole ratio of hydrogen fluoride to 1,1,1,3,3,3-hexachloropropane is from about 2:1 to about 100:1.

55. The process of claim 45 wherein the mole ratio of hydrogen fluoride to 1,1,1,3,3,3-hexachloropropane is from about 6:1 to about 20:1.

56. The process of claim 45 further comprising feeding chlorine to the fluorinating reaction to keep the fluorination catalyst active.

57. The process of claim 32 wherein the 1-chloro-1,1,3,3,3-pentafluoropropane and/or 1,1,1,3,3,3-hexafluoropropane are previously prepared by fluorinating 1,1,1,3,3,3-hexachloropropane with hydrogen fluoride in a liquid phase in the presence of a fluorination catalyst.

58. The process of claim 57 wherein hydrogen fluoride resulting from the dehydrofluorination of 1,1,1,3,3,3-hexafluoropropane is recycled to the reaction of fluorinating 1,1,1,3,3,3-hexachloropropane.



59. The process of claim 57 wherein said fluorination catalyst is selected from the group consisting of transition metal halides, Group IVb metal halides, Group Vb metal halides and combinations thereof.

60. The process of claim 57 wherein said fluorination catalyst is selected from the group consisting of  $\text{SbCl}_5$ ,  $\text{SbCl}_3$ ,  $\text{SbF}_5$ ,  $\text{TaCl}_5$ ,  $\text{SnCl}_4$ ,  $\text{NbCl}_5$ ,  $\text{TiCl}_4$ ,  $\text{MoCl}_5$ , and combinations thereof.

61. The process of claim 57 wherein said fluorination catalyst is selected from the group consisting of  $\text{SbCl}_5$ ,  $\text{SbCl}_3$  and combinations thereof.

62. The process of claim 57 wherein the fluorinating is conducted at a temperature of from about  $50^\circ\text{C}$  to about  $450^\circ\text{C}$ .

63. The process of claim 57 wherein the fluorinating is conducted at a temperature of from about  $65^\circ\text{C}$  to about  $150^\circ\text{C}$ .

64. The process of claim 57 wherein the fluorinating is conducted at a pressure of from about 50 psig and 400 psig.

65. The process of claim 57 wherein the fluorinating is conducted at a pressure of from about 60 psig and 200 psig.

66. The process of claim 57 wherein the mole ratio of hydrogen fluoride to 1,1,1,3,3,3-hexachloropropane is from about 2:1 to about 100:1.

67. The process of claim 57 wherein the mole ratio of hydrogen fluoride to 1,1,1,3,3,3-hexachloropropane is from about 6:1 to about 20:1.

68. The process of claim 57 further comprising feeding chlorine to the fluorinating reaction to keep the fluorination catalyst active.
69. The process of claim 1 wherein the reacting is conducted with a caustic in solid form.
70. The process of claim 1 wherein the reacting is conducted with an aqueous caustic solution.
71. The process of claim 32 wherein the decomposing is conducted without a catalyst.
72. The process of claim 32 wherein the decomposing is conducted with a catalyst comprising a supported transition metal halide.
73. The process of claim 32 wherein the decomposing is conducted with a catalyst selected from the group consisting of supported transition metal oxides, bulk transition metal oxides, and combinations thereof.
74. A process for the manufacture of 1,1,3,3,3-pentafluoropropene comprising thermally decomposing a reactant comprising 1-chloro-1,1,3,3,3-pentafluoropropane, under conditions sufficient to dehydrochlorinate 1-chloro-1,1,3,3,3-pentafluoropropane, to form a reaction product which comprises 1,1,3,3,3-pentafluoropropene and wherein the decomposing is conducted either without a catalyst or with a catalyst selected from the group consisting of transition metal halides and oxides and combinations thereof.
75. A process for the manufacture of 1,1,3,3,3-pentafluoropropene comprising thermally decomposing a reactant comprising at least one of 1-chloro-1,1,3,3,3-pentafluoropropane and 1,1,1,3,3,3-hexafluoropropane, under conditions sufficient to dehydrochlorinate 1-chloro-1,1,3,3,3-pentafluoropropane and/or to dehydrofluorinate 1,1,1,3,3,3-hexafluoropropane, to form a reaction product which comprises 1,1,3,3,3-pentafluoropropene and wherein the decomposing is conducted with a catalyst selected

from the group consisting of iron halides, nickel halides, cobalt halides and combinations thereof.

IX. EVIDENCE APPENDIX

None.

X. RELATED PROCEEDINGS APPENDIX

None.